Syllabus for 4 Year Undergraduate Courses in Universities of Bihar

Bachelor of Science, Zoology

Prepared By :

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Zoology

(A)Major Core Courses

Sl. No.	Sem	Type of Course	Name ofCourse	Credits	Marks
1.	I	MJC-1 (T)	Diversity of Non-Chordates(T)	4	100
		MJC-1 (P)	Diversity of Non-Chordates(P)	2	100
2.	II	MJC-2 (T)	Diversity of Chordates (T)	4	100
		MJC-2 (P)	Diversity of Chordates (P)	2	100
3.	III	MJC-3 (T)	Comparative Anatomy(T)	3	100
		MJC-3 (P)	Comparative Anatomy(P)	2	100
		MJC-4 (T)	Physiology(T)	3	100
		MJC-4 (P)	Physiology(P)	1	100
4.	IV	MJC-5 (T)	Cell Biology (T)	3	100
		MJC-5 (P)	Cell Biology (P)	2	100
		MJC-6 (T)	Endocrinology (T)	3	100
		MJC-6 (P)	Endocrinology (P)	2	100
		MJC-7(T)	Ecology(T)	3	100
		MJC-7(P)	Ecology(P)	2	100
5	V	MJC-8 (T)	Biochemistry (T)	3	100
		MJC-8 (P)	Biochemistry (P)	2	100
		MJC-9 (T)	Genetics(T)	3	100
		MJC-9(P)	Genetics(P)	2	100
6	VI	MJC-10(T)	Developmental Biology(T)	3	100
		MJC-10(P)	Developmental Biology (P)	1	100
		MJC-11(T)	Evolution (T)	3	100
		MJC-11(P)	Evolution (P)	2	100
		MJC-12 (T)	Animal Behaviour(T)	3	100
		MJC-12(P)	Animal Behaviour(P)	2	100
7.	VII	MJC-13 (T)	Molecular Biology(T)	3	100
		MJC-13 (P)	Molecular Biology(P)	2	100
		MJC-14	Research Methodology	5	100
		MJC-15(T)	Immunology and microbiology (T)	4	100
		MJC-15(P)	Immunology and microbiology (P)	2	100
8.	VIII	MJC-16(T)	Instrumentation and Biometry	4	100

Sub Total = 80

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(B) Minor Courses to be offered by the Department for students of other Departments of Science

Sl. No.	Sem	Type of Course	Name of Course	Credits	Marks
1.	I	MIC-1 (T)	Diversity of Non-Chordates(T)	2	100
		MIC-1 (P)	Diversity of Non-Chordates(P)	1	100
2.	II	MIC-2 (T)	Diversity of Chordates (T)	2	100
		MIC-2 (P)	Diversity of Chordates (P)	1	100
3.	III	MIC-3(T)	Physiology(T)	2	100
		MIC-3(P)	Physiology(P)	1	100
4.	IV	MIC-4(T)	Ecology(T)	2	100
		MIC-4(P)	Ecology(P)	1	100
5.	V	MIC-5(T)	Cell Biology (T)	2	100
		MIC-5(P)	Cell Biology (P)	1	100
6.		MIC-6(T)	Genetics (T)	2	100
		MIC-6(P)	Genetics (P)	1	100
7.	VI	MIC-7(T)	Evolution (T)	2	100
		MIC-7(P)	Evolution (P)	1	100
8.		MIC-8(T)	Developmental Biology(T)	2	100
		MIC-8(P)	Developmental Biology (P)	1	100
9.	VII	MIC-9(T)	Animal Behaviour(T)	3	100
		MIC-9(P)	Animal Behaviour(P)	1	100
10.	VIII	MIC-10(T)	Endocrinology (T)	3	100
		MIC-10(P)	Endocrinology (P)	1	100

Sub Total = 32

(C) Multidisciplinary Courses to be offered

Sl. No.	Sem	Type of Course	Name of Course	Credits	Marks
1.	I	MDC-1	To be selected from the basket	3	100
2.	II	MDC-2	To be selected from the basket	3	100
3.	III	MDC-3	To be selected from the basket	3	100

Sub Total = 09

(D) Ability Enhancement Courses to be offered

Sl. No.	Sem	Type of Course	Name of Course	Credits	Marks
1.	I	AEC-1	MIL	2	100
2.	II	AEC-2	Environmental Science	2	100
3.	III	AEC-3	Disaster Risk Management	2	100
4.	IV	AEC-4	NCC/NSS/NGOs/Social Service/ Scout and Guide/Sports	2	100

Sub Total = 08

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(E) Skill Enhancement Courses to be offered

Sl. No.	Sem	Type of Course	Name of Course	Credits	Marks
1.	I	SEC-1	To be selected from the basket	3	100
2.	II	SEC-2	To be selected from the basket	3	100
3.	III	SEC-3	To be selected from the basket	3	100

Sub Total = 09

(F) Value Added Courses to be offered

Sl. No.	Sem	Type of Course	Name of Course	Credits	Marks
1.	I	VAC-1	To be selected from the basket	3	100
2.	II	VAC-2	To be selected from the basket	3	100

Sub Total = 06

Sl. No.	Sem	Type of Course	Name of Course	Credits	Marks
1.	v	INT-1	Summer Internship	4	100

Sl. No.	Sem	Type of Course	Name of Course	Credits	Marks
1.	VIII	RP-1	Research/Dissertation	12	100

Grand Total = 160 Credits

(G) Basket for Multidisciplinary Courses (MDC)

To be decided by Respective Department

(H) Basket for Skill Enhancement Courses (SEC)

See at the end of structure (this booklet)

(I) Basket for Value Added Courses (VAC)

See at the end of structure (this booklet)

Question Paper Pattern

The question paper pattern shall consist of three parts: -

1.Part A - Compulsory- Consisting of objective/Multiple choice type - each carrying two marks. 10x2= 20 marks

Part-B - Short answer type - Four questions are to be answered out of six questions. Each carrying five marks. 04x5 = 20 marks

Part- C - Long answer type questions. Three questions to be answered out of five Questions, each carrying ten marks. 03x10 = 30 marks

2. Examinations shall not be held on OMR Sheets strictly.

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Syllabus for Four-Year B.Sc. in Zoology

Programme Outcomes :

At the completion of the programme, students will attain:

PO1. Disciplinary knowledge: Capable of demonstrating comprehensive knowledge of major concepts, theoretical principles and experimental findings in Zoology and its different subfields including biodiversity, physiology, biochemistry, ecology, evolutionary biology, cell biology, molecular biology, immunology and genetics etc. learning of the various techniques, instruments, computational software used for analysis of animal's forms and functions.

PO2. Communication, thinking, reasoning and problem solving ability: to convey the intricate zoological information effectively and efficiently, rationally analyze and solve the problems related to animal sciences, seekingsolutions and logically solving them by experimentation and data processing.

PO3. Leadership quality &Team spirit: Ability to work effectively in a heterogeneous team and to recognise and mobilise relevant resources essential for a project, and manage the project in a responsible way by following ethical scientific conduct and bio-safety protocols.

PO4. Digitally literate: Capability of using computers for biological simulation, computation and appropriate software for biostatistics, and employing search tools to locate, retrieve, and evaluate zoology-related data.

PO5. Environment and Sustainability: Understand the environmental and sustainability issues, acquire self-paced and self-directed learning aimed at personal and social development.

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Programme Specific Outcomes :

At the completion of the programme, students will attain the ability to:

PSO1. Students should be able to identify, classify and differentiate diverse chordates and non- chordates based on their morphological, anatomical and systemic organization.

PSO2. They will also be able to describe economic, ecological and medical significance of various animals in human life. This will create a curiosity and awareness among them to explore the animal diversity and explore related career options. The procedural knowledge about identifying and classifying animals will provide students professional advantages in teaching, research and taxonomist jobs in various government organizations.

PSO3. Acquired practical skills in molecular biology; biotechnology; microscopy; enzymology and analytical biochemistry and genetics will provide an extra edge to our students, who wish to undertake higher studies.

PSO4. In-depth knowledge and understanding about comparative anatomy and developmental biology of various biological systems; and learning about the organisation, functions, strength and weaknesses of various systems will let students critically analyse the way evolution has shaped these traits in the human body.

PSO5. Acquired skills in diagnostic testings, haematology, histopathology, staining procedures etc. used in clinical and research laboratories will provide students opportunity to work in diagnostic or research laboratory. Deep understanding of different physiological systems and methods available to measure vital physiological parameters and to comprehend the mechanism behind occurrence of different life threatening disease *via* laboratory examination, assessment of basic physiological functions by interpreting physiological charts will help to find their career options.

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Semester -I

Major Course 1 (MJC-1)

Course Title	Credit	Credit Distribution	
		Theory	Practical
Diversity of Non-Chordata	6	4	2

Course outcomes: After completion of the course, students should be able to:

CO-1: Learn about the importance of systematics, taxonomy, and structural organization of non-chordates.

CO-2: Understand & Appreciate the diversity of non-chordates living in varied habits and habitats.

CO-3: Understand evolutionary history and relationships of different non-chordates through functional and structural affinities.

CO-4: Critically analyse the organization, complexity and characteristic features of non chordates.

CO-5: Recognize the life functions and the ecological roles of the animals belonging to different phyla.

CO-6: Enhance collaborative learning and communication skills through practical sessions, teamwork, group discussions, assignments, and projects.

MJC-1: Diversity of Non-Chordata (Theory: 4 credits) 40 hrs		
Unit	**Topics to be covered**	**No. of Lectures**
1	1. Introduction to Non-chordates: General characteristics and classification (up to order) of the following Phyla: Protozoa, Porifera, Cnidaria, Ctenophora, Platyhelminthes and Nemathelminths, Annelida, Arthropoda, Mollusca, Echinodermata.	8
2	2.1. Protozoa: Structure and Life cycle of Paramecium, Plasmodium, Entamoeba histolytica, Trypanosoma, L. donovani 2.2. Porifera: Spicules and Canal system in sponges; affinities of the Phylum	10
3	3.1. Cnidaria: Structure and Life Cycle: Obelia, Aurelia 3.2. Ctenophora: General organization of Hormiphora; affinities of the phylum. 3.3 Platyhelminthes and Nemathelminthes: Structure and Life cycle of *Fasciola hepatica, Taenia solium, Ascaris lumbricoides.*	10
4	4.1. Annelida: Earthworm, Leech: Structure, locomotion, alimentary canal Reproduction. 4.2. Arthropoda: Peripatus, Adaptive variations in insect mouth parts. 4.3. Mollusca: Structure and Life cycle: Unio, Pila. Torsion and Detorsion in Gastropoda 4.4. Echinodermata: Structure: Star fish; Larval forms in Echinoderms; Water Vascular System in Echinoderms	12
	TOTAL	**40**

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MJC-1: Diversity of Non-Chordata (Practical: 2 credits) 20 hrs

Practical:

1. Study of whole mount of Euglena, Amoeba, Paramecium,Monocystis; Binary fission and Conjugation in Paramecium.
2. Study of Sycon; T.S. of Sycon, L.S. of Sycon; Gemmule, Hyalonema.
3. Permanent stained preparation of spicules of sponges.
4. Study of *Obelia, Aurelia, Metridium ,Physalia.*
5. Specimen/slide of any one Ctenophore.
6. Study of adult *Fasciola hepatica, Taenia solium*and*Ascaris* (male & female).
7. Study of Aphrodite, Septal nephridia and Ovary of Earthworm; Jaws of leech;Trochophore larva.
8. Study of T.S. through pharynx, gizzard, and typhlosolar region of earthworm.
9. Study of Limulus, Scolopendra, Grasshopper, Phyllium,Praying mantis, &Palaemon, Sacculina, Cancer, Eupagurus, Apis, Musca. Salivary gland of Cockroach,Mouth parts of Mosquito.
10. Study of Chiton, Dentalium, Octopus, Glochidim larva.
11. Study of Asterias, Echinus, Antedon.

Suggested Books:

1. Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates:A New Synthesis*, III Edition, Blackwell Science.
3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson.
4. Verma P S, Jordan E L. (2009). Invertebrate Zoology. S. Chand publishers.
5. Brusca R C (2016). Invertebrates. Published by Sinauer Associates, an imprint of Oxford University Press.
6. S.S.Lal, Practical Zoology Invertebrate.

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Semester -I
Minor Course 1 (MIC-1)

Course Title	Credit	Credit Distribution	
		Theory	Practical
Diversity of Non-Chordata	3	2	1

Course outcomes: After completion of the course, students should be able to:

CO-1: Learn about the importance of systematics, taxonomy, and structural organization of non-chordates.

CO-2: Critically analyse the organization, complexity and characteristic features of non chordates.

CO-3: Recognize the life functions and the ecological roles of the animals belonging to different phyla.

MIC-1: Diversity of Non-Chordata (Theory: 2credits) 20 hrs		
Unit	**Topics to be covered**	**No. of Lectures**
1	I. Introduction to Non-chordates General characteristics and classification (up to order) of the following Phyla: Protozoa, Porifera, Cnidaria, Ctenophora, Platyhelminthes and Nemathelminths, Annelida, Arthropoda, Mollusca, Echinodermata.	5
2	2. Structure and life history of:- (i) Protozoa - Paramecium (ii) Porifera - Sycon	4
3	3. Structure and life history of:- (iii) Cnidaria - Obelia (iv) Platyhelminthes - Fasciola (v) Aschelminthes - Ascaris	5
4	4. Study of coelomates:- (vi) Annelida - Pharetima (vii) Arthropoda - Palaemon (viii) Mollusca - Pila (ix) Echinodermata - Asteries (x) Hemichordata - Balanoglossus	6
	TOTAL	20

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MIC-1: Diversity of Non-Chordata (Practical) 10 hrs	**(1 credit)**

Practicals:

1. Study of whole mount of *Euglena, Paramecium, Leishmania*
2. Study of Sycon, Spongilla, T.S. of Sycon, L.S. of Sycon.
3. Study of *Obelia, Aurelia, Gorgonia*
4. Study of adult *Fasciola hepatica, Taenia solium*and their life stages
5. Study of *Pheretima, Hirudinaria*
6. Study of T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm.
7. Study of *Limulus*, *Palaemon, Apis.*
8. Mouth parts of Mosquito and Cockroach.
9. Study of *Pila, Unio.*
10. Study of *Asterias.*

Suggested Books :

1. Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates:A New Synthesis*, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
4. Verma P S, Jordan E L. (2009). Invertebrate Zoology. S. Chand publishers
5. Brusca R C (2016). Invertebrates. Published by Sinauer Associates, an imprint of Oxford University Press.
6. S.S.Lal, Practical Zoology Invertebrate.

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Semester 1
Multidisciplinary Course 1 (MDC-1)

Course Title	Credit	Credit Distribution	
		Theory	Practical
Diversity of Non-Chordata	3	2	1

Course outcomes: After completion of the course, students should be able to:

CO-1: Learn about the importance of systematics, taxonomy, and structural organization of non-chordates.

CO-2: Critically analyse the organization, complexity and characteristic features of non chordates.

CO-3: Recognize the life functions and the ecological roles of the animals belonging to different phyla.

MDC-1: Diversity of Non-Chordata (Theory: 2credits) 20 hrs		
Unit	**Topics to be covered**	**No. of Lectures**
1	I. Introduction to Non-chordates General characteristics and classification (up to order) of the following Phyla: Protozoa, Porifera, Cnidaria, Ctenophora, Platyhelminthes and Nemathelminths, Annelida, Arthropoda, Mollusca, Echinodermata.	5
2	2 Structure and life history of:- (i) Protozoa - Paramecium (ii) Porifera - Sycon	4
3	3. Structure and life history of:- (iii) Cnidaria - Obelia (iv) Platyhelminthes - Fasciola (v) Aschelminthes - Ascaris	5
4	4. Study of coelomates: (vi) Annelida - Pharetima (vii) Arthropoda - Palaemon (viii) Mollusca - Pila (ix) Echinodermata - Asteries (x) Hemichordata - Balanoglossus	6
	TOTAL	**20**

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MJC-1: Diversity of Non-Chordata (Practical) 10 hrs **(1 credit)**

Practicals :

1. Study of whole mount of *Euglena, Paramecium, Leishmania*
2. Study of Sycon, Spongilla, T.S. of Sycon, L.S. of Sycon.
3. Study of *Obelia, Aurelia, Gorgonia*
4. Study of adult *Fasciola hepatica, Taenia soliumand* their life stages
5. Study of *Pheretima, Hirudinaria*
6. Study of T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm.
7. Study of *Limulus*, *Palaemon, Apis.*
8. Mouth parts of Mosquito and Cockroach.
9. Study of *Pila, Unio.*
10. Study of *Asterias.*

Suggested Books :

1. Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates:A New Synthesis*, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
4. Verma P S, Jordan E L. (2009). Invertebrate Zoology. S. Chand publishers
5. Brusca R C (2016). Invertebrates. Published by Sinauer Associates, an imprint of Oxford University Press.
6. S.S.Lal, Practical Zoology Invertebrate.

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Semester 2

Major Course 2 (MJC-2)

Course Title	Credit	Credit Distribution	
		Theory	Practical
Diversity of Chordates	6	4	2

Course Outcomes: After completion of the course, the students will be able to:

CO-1: Understand different classes of chordates, level of organization and evolutionary relationship between different subphyla and classes, within and outside the phylum.

CO-2: Study about diversity in animals making students understand about their distinguishing features.

CO-3: Appreciate similarities and differences in life functions among various groups of animals in Phylum Chordata.

CO-4: Comprehend the circulatory, nervous and skeletal system of chordates.

CO-5: Know about the habit and habitat of chordates in marine, freshwater and terrestrial ecosystems.

MJC-2: Diversity of Chordates (Theory: 4 credits) 40 hrs		
Unit	**Topics to be covered**	**No. of Lectures**
1	**1.** Introduction to Chordates General characteristics and classification (upto Order): Cephalochordata, Urochordata,Pisces, Amphibia, Reptilia, Aves, Mammals, Cyclostomata.	8
2	**2**. Origin and Evolution of Chordata. **3.**Cephalochordata: Amphioxus. **4.** Urochordata: Herdmania(including retrogressive metamorphosis). **5.**Cyclostomata: Petromyzon.	10
3	**6.**Pisces: Migration, Osmoregulation, and accessory respiration. **7.**Amphibia: Origin and Evolution; Parental care, Neoteny. **8.** Reptilia: Poison and nonpoisionous snakes; Poision apparatus; biting and feeding mechanism in snakes.	12
4	**9.**Aves: Origin of birds; Flight adaptations; Migration in birds. **10.** Mammals: Characters, distribution and affinities of Prototheria Metatheria, Eutheria.	10
	TOTAL	**40**

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MJC-2: Diversity of Chordates (Practical: 2 credits)	20 hrs

Practical:

1. Amphioxus: T.S through pharyngeal, intestinal, and caudal regions.
2. Herdmania: Whole mount, Spicules.
3. Cyclostomata: Petromyzon, Myxine.
4. Fish: Scoliodon, Torpedo, Chimaera, Labeo, Exocoetus, Echeneis, Hippocampus; Scales of fishes.
5. Amphibia: Ichthyophis, Bufo, Hyla, Alytes, Salamandra,Axolotle larva.
6. Reptilia: Chelone, Hemidactylus, Varanus, Vipera, Naja, Bungarus, Uromastix, Chamaeleon, Draco,Calotes,Heloderma; Key for Identification of poisonous and non-poisonous snakes.
7. Aves: Types of beaks and claws, Study of pecten from fowl head and brain of fowl.
8. Mammalia: *Sorex*, Bat (Insectivorous and Frugivorous), *Funambulus, Loris, Herpestes, Erinaceous.Macropus,Echidna.*

Suggested Books:

1. Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
2. Pough H. *Vertebrate life,* VIII Edition, Pearson International.
3. Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.
5. Classification from Young, J. Z. (2004) to be followed.
6. S.S.Lal, Practical Zoology Vertebrates.

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Semester 2

Minor Course 2 (MIC-2)

Course Title	Credit	Credit Distribution	
		Theory	Practical
Diversity of Chordates	3	2	1

Course Outcomes: After completion of the course, the students will be able to:

CO-1: To understand the General Characteristics and Classification of Hemichordata, Urochordata and Cephalochordata, the Larval forms of Protochordata and Retrogressive Metamorphosis in Urochordata

CO-2: To acquire knowledge about the General Characters and Classification of Agnatha, Pisces and Amphibia.

CO-3: To understand the General Characteristics and Classification of Reptilia, Aves and Mammals, Biting Mechanism in Snakes, Flight Adaptations in Birds and Migration in Birds.

MIC-2: Diversity of Chordates (Theory: 2credits) 20 hrs		
Unit	**Topics to be covered**	**No. of Lectures**
1	**1.**General characteristics and classification (upto Order): Cephalochordata, Urochordata,Pisces, Amphibia, Reptilia, Aves, Mammals, Cyclostomata.	5
2	**2.**Cephalochordata: Amphioxus. **3.** Urochordata: Herdmania (including retrogressive metamorphosis).	4
3	**4.**Pisces: Scoliodon. **5.** Reptilia: Biting and feeding mechanism in snakes.	5
4	**6.**Aves: Flight adaptations, Elementary idea of migration. **7.** Mammals: Characters, distribution and affinities of Prototheria & Metatheria.	6
	TOTAL	**20**

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MIC-2: Diversity of Chodates (Practical) 10 hrs (1 credit)

Practical :

1.Amphioxus: Section through pharyngeal, intestinal, and caudal regions.

2. Herdmania: Whole mount, Spicules
2. Cyclostomata: Petromyzon, Myxine
3. Fish: Scoliodon, Torpedo, Chimaera, Labeo, Exocoetus, Echeneis, Hippocampus; Scales of fishes
4. Amphibia: Ichthyophis, Bufo, Hyla, Alytes, Salamandra,Axolotle larva
5. Reptilia: Chelone, Hemidactylus, Varanus, Vipera, Naja, Bungarus, Uromastix, Chamaeleon, Draco,Calotes,Heloderma; Key for Identification of poisonous and non-poisonous snakes
6. Aves: Types of beaks and claws, Study of pecten from fowl head and brain of fowl.
7. Mammalia: *Sorex*, Bat (Insectivorous and Frugivorous), *Funambulus, Loris, Herpestes, Erinaceous.Macropus,Echidna*

Suggested Books :

1. Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
2. Pough H. *Vertebrate life,* VIII Edition, Pearson International.
3. Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.
5. Classification from Young, J. Z. (2004) to be followed.
6. S.S.Lal, Practical Zoology Vertebrates

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Semester 2
Multidisciplinary Course 2 (MDC-2)

Course Title	Credit	Credit Distribution	
		Theory	Practical
Diversity of Chordates	3	2	1

Course Outcomes: After completion of the course, the students will be able to:

CO-1: To understand the General Characteristics and Classification of Hemichordata, Urochordata and Cephalochordata, the Larval forms of Protochordata and Retrogressive Metamorphosis in Urochordata

CO-2: To acquire knowledge about the General Characters and Classification of Agnatha, Pisces and Amphibia.

CO-3: To understand the General Characteristics and Classification of Reptilia, Aves and Mammals, Biting Mechanism in Snakes, Flight Adaptations in Birds and Migration in Birds.

MDC-2: Diversity of Chordates (Theory: 2credits) 20 hrs		
Unit	**Topics to be covered**	**No. of Lectures**
1	**1.**General characteristics and classification (upto Order): Cephalochordata, Urochordata,Pisces, Amphibia, Reptilia, Aves, Mammals, Cyclostomata.	5
2	**2.**Cephalochordata: Amphioxus. **3.** Urochordata: Herdmania (including retrogressive metamorphosis).	4
3	**4.**Pisces: Scoliodon. **5.** Reptilia: Biting and feeding mechanism in snakes.	5
4	**6.**Aves: Flight adaptations, Elementary idea of migration. **7.** Mammals: Characters, distribution and affinities of Prototheria & Metatheria.	6
	TOTAL	**20**

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MDC-2: Diversity of Chodates (Practical) 10 hrs (1 credit)

Practical

1.Amphioxus: Section through pharyngeal, intestinal, and caudal regions.

2. Herdmania: Whole mount, Spicules
2. Cyclostomata: Petromyzon, Myxine
3. Fish: Scoliodon, Torpedo, Chimaera, Labeo, Exocoetus, Echeneis, Hippocampus; Scales of fishes
4. Amphibia: Ichthyophis, Bufo, Hyla, Alytes, Salamandra,Axolotle larva
5. Reptilia: Chelone, Hemidactylus, Varanus, Vipera, Naja, Bungarus, Uromastix, Chamaeleon, Draco,Calotes,Heloderma; Key for Identification of poisonous and non-poisonous snakes
6. Aves: Types of beaks and claws, Study of pecten from fowl head and brain of fowl.
7. Mammalia: *Sorex*, Bat (Insectivorous and Frugivorous), *Funambulus, Loris, Herpestes, Erinaceous.Macropus,Echidna*

Suggested Books :

1. Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
2. Pough H. *Vertebrate life,* VIII Edition, Pearson International.
3. Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.
5. Classification from Young, J. Z. (2004) to be followed.
6. S.S.Lal, Practical Zoology Vertebrates.

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